

REMARKS

Claims 1-44 were presented.

Claims 21-44 have been withdrawn from consideration by the Examiner.

Paragraph [0067] of the originally-filed Specification was objected to as containing a typographical error, which error has been corrected by amendment. No new matter is introduced by the amendment.

Claims 12-15 were rejected under 35 U.S.C. §112, second paragraph, as reciting "percent" without making clear whether the intended units are weight percent or atomic percent. Claim 16 as filed also suffers from the same symptom, but was not so indicated in the Office action. Claim 12 has been amended to recite "mole percent" (because NaCN is a compound). Support for the amendments is found throughout the Specification as filed, and particularly in Figs. 3, 6, 7, 9, 13, 14, 26, and 27, Tables I, V, and the corresponding descriptions of those tables and diagrams.

Claim 12 has been amended to recite a pH of at least 8 rather than a pH of at least 11. Support for a pH of 8 is found throughout the Specification as originally filed, and in particular at paragraph [0068] of the specification as originally filed. Since a pH of at least 8 includes pH from 8 to 14, whereas a pH of at least 11 covers only pH from 11 to 14, this amendment is not a narrowing amendment. No new matter is introduced by the amendment.

Each of claims 13-16 have been amended to recite "to remove X% of the original quantity of said metallic component" (where X is a numerical value) so that the amount of reduction of the metal is measured according to absolute percent, e.g., 90% reduction implies that only one-tenth of the original amount of the metallic component remains (such as, in Fig. 13 and Table I, original 4.7 atomic percent reduced to 0.44 atomic percent, or only $0.44/4.7 = 0.093 = 9.3\%$ of the original amount of the metallic component remains). Support for the amendments is found throughout the Specification as filed, and particularly in Figs. 3, 6, 7, 9, 13, 14, 26, and 27, Tables I, V, and the corresponding descriptions of those tables and diagrams.

Claim 18 has been amended to recite that the substrate comprises an oxide, rather than that the substrate comprises a metal oxide. Support for a substrate comprising an oxide is found throughout the Specification as originally filed, and in particular at paragraph [0014] of

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the specification as originally filed. Since "an oxide" is broader than "a metal oxide" because an oxide comprises oxides that may not contain a metal, this amendment is not a narrowing amendment. No new matter is introduced by the amendment.

The Office action defines the following references, which will be adhered to hereinbelow:

Reference D1 is United States Patent Application Publication US 2002/0147103 A1 by Ruettinger et al., published October 10, 2002;

Reference D2 is Liu and Flytzani-Staphanopoulos, Total oxidation of carbon monoxide and methane over transition metal-fluorite oxide composite catalysts, J. Catal. 153 (1995) 3004-332;

Reference D3 is Bartlett et al., Solution Mining, 2nd Edition, Gordon and Breach Science Publishers, (1998) pages 17-18, 20-22, 39; and.

Reference D4 is U.S. Patent No. 6,723,298 issued April 20, 2004 to Baumann.

The Office action admits at page 5 that "D1 fails to teach removing some of the metallic crystalline particles from the surface."

Claims 1-18 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over D2 in view of D3.

Claim 19 was rejected under 35 U.S.C. §103(a) as being unpatentable over D2 in view of D3 and further in view of D4.

Examiner Jennifer Smith and Supervisory Patent Examiner Jerry Lorengo are thanked for a telephonic interview that took place on September 18, 2008, in which the undersigned participated. The interview discussion covered the rejection of the claims under 35 U.S.C. §103(a), the cited art, and the claims. The Applicants proposed arguments that Applicants believe show that the claims as presently amended are patentable over the cited art. The Examiners indicated that the arguments would be taken into account and that a further search might be required, which search might disclose further material art.

Comments on 35 U.S.C. §103(a) in View of KSR International v. Teleflex

In *KSR International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 167 L.Ed.2d 705, 82

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U.S.P.Q.2d 1385 (2007), the Supreme Court of the United States reaffirmed *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966) but rejected the rigid application of the Teaching-Suggestion-Motivation ("TSM") test. The KSR Court expressed the following principles of law as regards obviousness, in which citations are omitted.

In *Graham*, the Court set out a framework for applying the statutory language of §103, language itself based on the logic of the earlier decision in *Hotchkiss v. Greenwood* and its progeny. See 383 U.S., at 15-17, 86 S.Ct. 684. The analysis is objective:

"Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *Id.*, at 17-18, 86 S.Ct. 684.

While the sequence of these questions might be reordered in any particular case, the factors continue to define the inquiry that controls. If a court, or patent examiner, conducts this analysis and concludes the claimed subject matter was obvious, the claim is invalid under §103.

KSR at 1734.

... The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

KSR at 1739.

In *United States v. Adams*, 383 U.S. 39, 40, 86 S.Ct. 708, 15 L.Ed.2d 572 (1966), a companion case to *Graham*, the Court considered the obviousness of a "wet battery" that varied from prior designs in two ways ... The Court relied upon the corollary principle that when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious.

KSR at 1739-1740.

Finally, in *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 96 S.Ct. 1532, 47 L.Ed.2d 784 (1976), the Court derived from the precedents the conclusion that when a patent “simply arranges old elements with each performing the same function it had been known to perform” and yields no more than one would expect from such an arrangement, the combination is obvious. *Id.*, at 282, 96 S.Ct. 1532.

KSR at 1740.

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability.

KSR at 1740.

Following these principles may be more difficult in other cases than it is here because the claimed subject matter may involve more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement. ... To facilitate review, this analysis should be made explicit. See *In re Kahn*, 441 F.3d 977, 988 (C.A.Fed.2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”). As our precedents make clear, however, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

KSR at 1740-1741.

As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.

KSR at 1741.

The *Adams* case makes at least two points that have relevance here. One is that **when the prior art teaches away from combining certain known elements**, discovery of a successful means of combining them is more likely to be nonobvious. Another is that **a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in**

the prior art.

The KSR Court explicitly instructed that “[i]f a person of ordinary skill can implement a **predictable** variation, §103 likely bars its patentability.” Determining predictability is a required element of the analysis. In the absence of predictability the analysis would be expected to yield a conclusion of non-obviousness.

In addition, the KSR Court accepts that “[t]o facilitate review, this analysis should be made explicit.” It quotes the Kahn Court to the effect that “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, **there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.**”

Response to Rejection of Claims 1-20 under 35 U.S.C. §103(a)

Reference D1 and Reference D4 teach catalysts useful for the water gas shift reaction. *See* Reference D1 Title, Abstract, and at paragraph [0002], as examples. *See* Reference D4 at column 1, lines 25-28.

The references make clear that specific catalytic compositions operate under certain defined conditions, and may be damaged or may be ineffective under other conditions of temperature and composition of the reaction medium or ambient. It is therefore difficult or impossible to predict that a catalytic composition that operates under one set of operating conditions will operate under distinctly different operating conditions.

Reference D1 teaches, at paragraph [0007], that catalysts used for the water gas shift reaction can be deactivated or damaged under certain operating conditions:

A problem encountered in water-gas shift processes using non-pyrophoric, copper-based water gas shift catalysts as disclosed in copending U.S. patent application Ser. No. 09/771,812, filed Jan. 29, 2001, is the decline in catalytic activity at lower temperatures in the presence of steam (H₂O). For example, at or below temperatures of about 220 °C., copper-based water-gas shift catalysts are deactivated by the presence of steam (H₂O). The problem of catalytic deactivation is of particular importance during startup and shutdown of water-gas shift reactors containing copper-based catalysts, wherein the temperature is dropped below the dew point of the input gas stream. Steam induced deactivation can also occur gradually, whereby the levels of unconverted carbon monoxide (CO) remaining downstream from the catalyst

gradually rise with time. This gradual rise in downstream CO concentration while carrying out the water-gas shift reaction is indicative of a catalytic instability found in many different copper-based, low temperature water-gas shift catalysts that operate below 220 °C. In an industrial setting, where reaction conditions can be carefully monitored controlled, appropriate controls and protocols serve to prevent the deactivating effects of low temperature steam exposure. For example, the deactivation of certain copper-based water gas shift reaction catalysts can be reversed by oxidation under dry conditions, followed by reduction of the catalyst with dry hydrogen. These procedures, however, are not easily implemented in a fuel processor that would be used in a vehicle, or in a residential setting.

Reference D4 also teaches, at column 2, lines 1-12, that catalysts used for the water gas shift reaction can be deactivated or damaged under certain operating conditions, and that catalysts used under inappropriate operating conditions may provide insufficient activity or may catalyze unwanted reactions:

The described two stage conduct of the process is necessary because of the properties of these catalysts. While Cu/ZnO-containing catalysts become deactivated above 270 °C. because of recrystallization, or sintering, of the copper, the Fe/Cr-containing catalysts that are used in the high temperature range cannot be used at low temperatures because of insufficient activity. If the indicated temperature range of the high temperature catalysts is exceeded, methanation reactions (reaction equations (2) and (3)) can occur, which reduce the selectivity of the high temperature catalyst and because of this lower the overall efficiency of the hydrogen generation system.

The water gas shift reaction is one in which CO (carbon monoxide) and water react to produce hydrogen and CO₂ (carbon dioxide) as shown in equation (1) of Reference D4 and paragraph [0005] of the present application as published (Patent Application Publication No. US 2006/0128565 A1). In the water gas shift reaction, the oxygen necessary to convert carbon monoxide to carbon dioxide is provided by the water. One of the purposes of conducting the water gas shift reaction is to provide hydrogen as a substance to be consumed in fuel cells. Another purpose of conducting the water gas shift reaction is to remove carbon monoxide from a gas stream because carbon monoxide can poison certain catalytic materials.

It is admitted at page 5 in the Office action that Reference "D1 fails to teach removing some of the metallic crystalline particles from the surface." In fact, reference D1 does not

teach or suggest any form of removal of material, for example by etching or dissolution, from the catalyst surface. An electronic search of the text of D1 as available on the USPTO web site fails to disclose any usage of the terms "etch" or "dissolve" in any of their variants other than a single reference at paragraph [0103] as follows:

The calcined 1/8-inch particles were then impregnated (i.e., impregnated at 55% incipient wetness to obtain about 15 wt.% CeO₂) in an aqueous solution of cerium nitrate (i.e., Ce(NO₃)₃, 33.44 g Ce(NO₃)₃ **dissolved** in 55 g water, per 100 g alumina). (emphasis added)

Reference D4 also fails to teach or suggest removing some of the metallic crystalline particles from the surface. In fact, reference D4 does not teach or suggest any form of removal of material, for example by etching or dissolution, from the catalyst surface. An electronic search of the text of D4 as available on the USPTO web site fails to disclose any usage of the terms "etch" or "dissolve" in any of their variants other than a single reference at column 5, lines 63-66, as follows:

... The **dissolved** components of the suspension are then precipitated onto the suspended support material through the addition of a basic precipitation agent such as sodium hydroxide. ... (emphasis added)

Applicants respectfully submit that references D1 or D4 relate to catalysts useful for the water gas shift reaction. However, neither reference teaches or suggests any form of removal of material, for example by etching or dissolution, from the catalyst surface.

Reference D2 was published by the Applicants. Reference D2 does not relate to the water gas shift reaction. Rather, reference D2 teaches catalysts of various types that are useful for the total oxidation of carbon monoxide and methane, which involves the introduction of oxygen, for example from air. At page 304, in the abstract, reference D2 teaches the oxidation of carbon monoxide in air at room temperature, and the oxidation of methane (CH₄) at about 550 °C. On the same page, in the left hand column, first five (5) lines of the section titled "I. INTRODUCTION" there is the statement: "Carbon monoxide and gaseous hydrocarbons are ubiquitous air pollutants emitted by many sources. Complete

oxidation of these pollutants to carbon dioxide and water over active catalysts is used to meet continually changing environmental regulations in an economic way.” In the right hand column of page 304, at lines 4-8, reference D2 teaches: “Methane is the most refractory hydrocarbon and thus, is often used as model hydrocarbon compound for activity tests. In addition, methane itself is a potent greenhouse gas and the emission control of unburned methane from exhaust gases may be regulated in the future.” It should be apparent that such total oxidation is incompatible with the water gas shift reaction, in which hydrogen is a product, because in the presence of air, hydrogen will be oxidized to water, and will not be available as a product.

At page 305, left hand column, lines 15-18, reference D2 teaches with respect to an oxidation reaction of carbon monoxide with sulfur dioxide, that “[f]urther activity enhancement and catalyst resistance to water vapor and carbon dioxide poisoning were achieved by doping the fluorite oxide with transition metals, such as copper, cobalt, or nickel.”

Reference D3 teaches solution mining methods, in which the intention is to extract metals having economic value from ores. In particular, reference D3 describes the heap leaching of ores containing gold (Au) for lengthy periods of up to weeks (*see* Figure 2.2 – period of up to 8 days, *see* Figure 2.3 – period of up to 4 weeks, and *see* Figure 2.4 – period up to 100 weeks) for the specific purpose of removing all of the gold. Dissolution of metallic gold in cyanide solution containing oxygen is well known, and is described for mining purposes by reference D3, at equation 2.1. There is no discussion of any kind of reaction such as the water gas shift reaction or of the oxidation of carbon monoxide or of hydrocarbons such as methane.

Response to Rejection of Claims 1-20 under 35 U.S.C. §103(a)

For the record, the Applicants are the authors of reference D2, and they submitted that reference under their duty to disclose as required by 37 C.F.R. §1.56.

Claims 1-18 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over D2 in view of D3.

The Examiner has a burden of presenting some articulated reasoning with some rational underpinning to combine the teachings of two or more patents, which must be found independent from (or without reliance on) the teachings of the application being examined.

The Office action argues with regard to claims 1 and 2, that D2 teaches “[a] lanthanum-cerium nanocrystalline support is provided. Gold nanoparticles (crystalline structure) are deposited on the support. **The total structure lacks a shared crystalline structure.**” (emphasis added)

Applicants respectfully submit that the support taught by D2 is in fact a lanthanum-doped cerium oxide support. Applicants respectfully submit that the lanthanum-doped cerium oxide is an oxide that is substantially an insulator and is not metallic in its conductive behavior.

Applicants respectfully remind the Examiner that claim 1 recites the following:

A method of preparing a catalyst material, comprising the steps of:

providing a substrate component having a surface;

producing on said surface of said substrate component a second component having metallic crystalline particles and a structure lacking crystallinity;
and

removing selectively from said surface of said substrate component at least some of said metallic crystalline particles, leaving associated with said substrate component at least a portion of said structure lacking crystallinity;
whereby said remaining structure lacking crystallinity associated with said substrate component exhibits catalytic activity. (emphasis added)

Applicants concede that reference D2 teaches a substrate component having a surface, namely the lanthanum-doped cerium oxide. In fact, reference D2 shows an x-ray diffraction pattern of a gold - lanthanum-doped cerium oxide material at Fig. 1 on page 319 that shows that the lanthanum-doped cerium oxide diffracts x-rays, meaning that it has a crystalline structure.

There is no evidence presented in D2 that the gold nanoparticles deposited on the lanthanum-cerium nanocrystalline support comprise **a second component having metallic**

crystalline particles and a structure lacking crystallinity as is required by the plain language of claim 1. The argument by the Examiner that “[t]he total structure lacks a shared crystalline structure” is irrelevant, because the cited clause requires that the metallic component (which clearly is not satisfied by the crystalline lanthanum-doped cerium oxide substrate of D2) have two parts, namely, first, metallic particles, and second, a structure lacking crystallinity. The gold nanoparticles satisfy only the first part (metallic particles). There is no disclosure in reference D2 that teaches or suggests the presence of a structure lacking crystallinity.

The argument presented in the Office action that the lanthanum-doped cerium oxide support and the gold nanoparticles do not share a single crystal structure is irrelevant, even if true. The claim language requires a second component that is provided on the surface of the substrate and therefore does not include the substrate itself. The Examiner does not have the luxury of asserting that the crystalline lanthanum-doped cerium oxide substrate component is a part of the second component as recited in the claim. The argument presented by the Examiner as regards claim 1 is therefore deficient on its face, because there is no teaching or suggestion in D2 of the presence of a structure lacking crystallinity, even if it does teach the presence of gold nanoparticles.

Applicants respectfully submit that reference D2 does not teach or suggest the step of “removing selectively from said surface of said substrate component at least some of said metallic crystalline particles, leaving associated with said substrate component at least a portion of said structure-lacking crystallinity.”

Reference D3 is asserted for the teaching that gold can be dissolved in cyanide leach solutions. However, reference D3 fails to teach anything about catalysts for performing chemical reactions of any kind, let alone how to make such catalysts, which is the subject matter of claim 1. The only thing that reference D3 is concerned with is the maximum removal of gold metal from gold ore, including leaching the ore in cyanide for extended periods of time.

Reference D3 provides no teaching or suggestion to adding a metallic substance to any substrate at all, so it cannot cure the failure of reference D2 to teach or suggest the step of

“producing on said surface of said substrate component a second component having metallic crystalline particles and a structure lacking crystallinity.”

There is absolutely no explanation or articulated reasoning with some rational underpinning why anyone would seek to combine a description of the total removal of gold using cyanide solution as taught in reference D3 with the discussion of catalysts for the total oxidation of carbon monoxide or total oxidation of hydrocarbons as taught in reference D2.

The only apparent basis for trying to make such a combination is the disclosure of the Applicants itself, which is an impermissible basis for making such a combination (“impermissible hindsight”). Certainly there is no basis for such a combination that appears in either reference D2 or reference D3. About the only thing the two references have in common is that they mention gold.

Applicants respectfully submit that the combination of reference D2 and reference D3 is not supported by any explanation or articulated reasoning with some rational underpinning, and therefore, that the combination of reference D2 and reference D3 is inappropriate. *Arguendo*, Applicants further respectfully submit that even if such a combination were supported by some argument or reasoning, that the combination still fails to teach or suggest the step of “producing on said surface of said substrate component a second component having metallic crystalline particles and a structure lacking crystallinity.” Accordingly, Applicants respectfully submit that claim 1 is patentable over the combination of reference D2 and reference D3 (assuming that such a combination is appropriate, which Applicants do not concede) and that there has not been given a *prima facie* rejection, because at least one step of claim 1 is not taught or suggested by either reference, alone or in combination.

By the same logic, Applicants respectfully submit that all of dependent claims 2-18 and 20, which depend directly or indirectly from claim 1, and which by operation of 35 U.S.C. §112, 4th paragraph include all of the steps of claim 1, are also patentable over the combination of reference D2 and reference D3 (assuming that such a combination is appropriate, which Applicants do not concede) and that there has not been given a *prima facie* rejection for any of claims 2-18 and 20, because at least one step of claim 1 is not taught or suggested by either reference, alone or in combination.

Claim 19 was rejected under 35 U.S.C. §103(a) as being unpatenable over D2 in view of D3 and further in view of D4.

The Office action states that reference D4 is asserted because it teaches a substrate support that can be made from a zeolite.

Applicants reassert here the above argument that the combination of reference D2 with reference D3 is unsupported.

Applicants respectfully submit that the combination of reference D4 with reference D2 is inappropriate for the following reason: it is a principle of patent law that two references may not be combined if either reference has to be modified to the point that it is no longer operative in order to be combined with the other reference. Here, reference D2 requires an atmosphere that contains excess oxygen in order to be able to perform the total oxidation reaction, while reference D4 requires the absence of oxygen so that the water gas shift reaction yields hydrogen (H_2) as a product, and not water (H_2O). Applicants respectfully submit that these operating conditions are mutually exclusive. Applicants further respectfully submit that information about a catalyst designed to work under one set of conditions will in general be of little use as regards a catalyst designed to work under the other set of conditions. *See*, for example, the discussion in reference D2 at page 304, first paragraph of the Introduction) regarding resistance to oxidation of the precious metal (Pt, Pd) catalysts commonly used for total oxidation reactions, and concerns about stability of base metal catalysts in the presence of water vapor.

Applicants respectfully submit that reference D4 does not teach or suggest the step of “producing on said surface of said substrate component a second component having metallic crystalline particles and a structure lacking crystallinity.”

Applicants respectfully submit that reference D4 does not teach or suggest the step of “removing selectively from said surface of said substrate component at least some of said metallic crystalline particles, leaving associated with said substrate component at least a portion of said structure lacking crystallinity.”

Applicants respectfully submit that the combination of reference D2 and reference D4 is not supported by any explanation or articulated reasoning with some rational underpinning,

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and therefore, that the combination of reference D2 and reference D4 is inappropriate.

Arguendo, Applicants further respectfully submit that even if such a combination were supported by some argument or reasoning, that the combination still fails to teach or suggest the step of “producing on said surface of said substrate component a second component having metallic crystalline particles and a structure lacking crystallinity.”

Applicants respectfully submit that dependent claim 19, which depends directly from claim 1, and which by operation of 35 U.S.C. §112, 4th paragraph includes all of the steps of claim 1, is patentable over the combination of reference D2, reference D3 and reference D4 (assuming that such a combination is appropriate, which Applicants do not concede) and that there has not been given a *prima facie* rejection, because at least one step of claim 19 is not taught or suggested by any of the three references, alone or in combination.

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CONCLUSION

Applicants have amended claims 12-16 to more particularly claim the invention. Claim 18 has been amended to recite that the substrate comprises an oxide. No new matter has been added by the amendments. Applicants respectfully request that the application be reconsidered and that the rejections of claims 1-20 be withdrawn for the reasons given above. Applicants submit that claims 1-20 are now in proper condition for allowance, and request the issuance of a Notice of Allowance at the Examiner's earliest convenience.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is requested to call Applicants' attorney at the phone number noted below.

Respectfully submitted,
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